Klepper & Simons: The Making of An Oligopoly: Firm Survival and Technological Change in the Evolution of the U.S. Tire Industry

1. What is paper's contribution?
   How does it push out frontier of knowledge?
   Determinants of market structure:
   Production scale economies - **Bain** (1956) & **Scherer et al.** (1975) say this doesn't appear to explain much of the cross-sectional variation in the manufacturing industry concentration ratios
   Marketing and distribution economist
   Technological change
   First-mover advantages
   "Shakeout" in tire industry - # firms declined 80% in 14 years
   Knox (1963) - mass distributing methods & decreased demand from increased tire mileage
   Jovanovic & MacDonalds (1994) - Banbury mixer (major process innovation)
   Warner (1966) - cost of staying up with the technological frontier in the post shakeout era was prohibitive for all but the leading firms
   French (1991) - technological change and marketing & distribution

   What do we know that we did not know before?
   New information on early evolution of tire industry; new data set assembled from firm price lists of product offerings (see #4)... coupled information with data of entry, date of exit, form of exit, size, location, and distribution network for each firm to analyze role of technological change
   New technology economized labor... "wholesale price index of tires declined from 175 in 1914 to 47 in 1937" (732)
   Finding - older and larger firms survived longer (because influence of age and size on technological change); firms located around geographic center of industry were more technologically progressive
   Key is using data from the time to test the theory; previous papers didn't really use data; they were more speculative

   Is this important or minor? Why?

2. Theory:
   Changing Technology - actually happened; theory deals with what this means to market structure
   Tire life increased (1000 to 20000 miles)
   Cord, fabric, balloon tire
   Labor productivity $\uparrow \Rightarrow$ price of tires $\downarrow$
   Klepper (1996) - model to explain shakeouts and evolution of market structure; assumes increasing returns from R&D
   Discrete Periods - "in each period a new "cohort" of potential entrants composed of start-ups and firms with experience in related technologies and industries arises" (734)
   Potential entrants are assumed to be heterogeneous in capabilities so only a fraction of potential entrants are capable of conducting innovation (rest are called "imitators")

Innovators invest in R&D to lower their average cost of production in that period ∴ profits gained from R&D are scaled by output of the firm (R&D in each period subject to diminishing returns); innovations costlessly imitated by all firms one period after they are introduced

Production has increasing scale economies at low output, then constant

Industry demand assumed to be constant over time

Firms are price takers

Firms exit because max profit is negative or "adverse decisions (i.e., probability of random exit, which is lower for innovators than for imitators)

Implications -

- Firms expand until MC of growth = price-cost margin (i.e., innovators are always larger than imitators in same period)
- Price declines over time ∴ initially innovators & imitators enter; then only innovators enter; then nobody enters (exit continues)... industry dominated by earliest entering innovators

Hypotheses (Table 2):

1. The likelihood of cord production falls and then rises with firm age and also falls and rises with firm size, and the dispersion of firm sizes is lower in early- and late-entry cohorts than in intermediate entry cohorts
2. Given the age and size of the firm, the likelihood of cord production is greater for firms located around Akron
3. The hazard of exit is lower for older firms and for firms located around Akron
4. Given firm size and cord production, the hazard of exit is unrelated to the age of the firm and whether it is located around Akron
5. For each size firm, the hazard of exit is lower for producers of the cord tire
6. Among producers of the cord tire, the hazard of exit is lower the larger the firm
7. Firm size lowers the hazard of exit more for producers than for nonproducers of the cord tire

Intuition -

Innovator - price-cost margin falling; firm that makes new innovations that can take advantage of lower cost are more likely to succeed

Hazard functions - explain change (e.g., why firms exit); prob. of exiting the market

3. Description of Variables

Age - based on year of entry

    Expectation -

    Problem - Mergers & acquisitions treated as continuation of leading producer (keeps name) and exit of other firms

Size - based on 1920 total capitalization: 1 of 11 categories ranging form $500-$1,000 to $1M and above; 12th category for unknown

    Expectation - see mergers in Age

Years Survived - based on year of exit

    Expectation - see mergers in Age

Akron - 1 if within 50 miles of Akron

    Expectation - technology spillovers make it worthwhile for firms to be located near Akron

Distribution - 1 if had distributor in large cities

    Expectation -

4. Sample:

    Source:

Thomas' Register of American Manufacturers and *Hendricks' Commercial Register of the United States for Buyers and Sellers* (age, years survived, location, size of each firm)

Sep 1917, October 1920, and October 1923 issues of *Tire Rate Book* (quarterly industry trade journal)

\# data points:
155 firms listed (111 listing cord tires)
8 producers of core tires in 1917
21 producers of balloon tire in 1923

Is sample appropriate or optimal for study?

Cord Producer
1

Size

5. Analysis
   Statistical Technique
   ??? (Table 3)
   Logit model (Table 4)
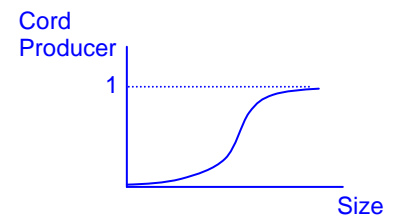   3 specifications for model 1... not clear on what the differences are
   Spec 2 - $f(0,1) = a - 0.474(\text{Entry}-1900) + 0.013(\text{Entry}-1900)^2$
   $\partial f/\partial(\text{Entry}-1900) = -0.474 + 2(0.013)(\text{Entry}-1900) = 0 \Rightarrow \text{Entry}-1900 = 18$
   Spec 3 - first one to account for size... not significant
   6 models for hazard of exit

   Results
   Once controlled for cord production, year of entry and location don't matter $\therefore$ technology is the driving force behind the industry structure
   Distribution network

6. Does paper do a good job of testing theory?
   Are there serious flaws?
   Good job of laying out theory and hypotheses, but doesn't explain technique for analyzing it very well

   How can the empirical work be improved?
   Not very good at explaining what he's doing with the analysis... looks like smoke and mirrors

Ajwad: New Evidence on the Link Between School Funding and Educational Outcomes: An Analysis Using School Campus-Level Data

1. What is paper's contribution?

How does it push out frontier of knowledge?

Education production function - students are intermediate inputs

Studies look at (a) direct measures of educational achievement (test scores) or (b) post-educational earnings

Hanushek (1996) - useful summary of 377 estimates of educational production functions from 90 published articles or books;

163 estimates of effect of expenditure per student on student achievement:

27% positive & significant

7% negative & significant

66% not significant... 35% positive; 19% negative; (rest unreported)

"the results lead to the conclusion that no strong or systematic relationship exists between expenditures and student performance" (4)

Betts (1996) - review of literature on relation between education resources and student career success (measured by earnings); strongest relationships measured with state-level data, but school-level data gives weaker result

"evidence in favor of a link between school resources and level of education reached is either weak or nonexistent" (5)

Sander (1993) - uses school-level data for Illinois; increase in teacher's salaries improve ACT scores & % college-bound students; increase in student-teacher ratio lowers graduation rates & % college-bound students

Ehrenbert & Brewer (1994) - school district expenditures per student; acknowledge and correct for endogeneity problem associated with school characteristics being the result of parental choices about which school to attend; "many of the included school characteristics are not statistically significant determinants of dropout rates or achievement test scores" (6)

Cullen (1997) - Texas; district expenditures per student to fraction of students passing state-administered exams, after controlling for demographic characteristics... "money does matter and is a positive determinant of educational outcomes" (6)

What do we know that we did not know before?

Unique school campus-level data; "there do not appear to be any studies that use school campus-level finance information to unravel the link between resources and educational outcomes" (2)

Whether education expenditures impact rich & poor students differently

Is this important or minor? Why?

"Judicial interest in equalizing resources across public school districts" (2)

2. Theory:

3. Description of Variables

Academic Performance - % passing = total number of students who passed the exam in all grades by total number of students taking the exam

Reading -

Writing -
Math -
All Three -
School Characteristics (school j)
Expenditures per Student (E_{jk}) -
Instruction - all activities dealing directly with interaction between teachers and students
Instructional Leadership - managing, direction, supervising, and providing leadership for staff who provide instructional services
School Leadership - involves directing and managing school
Campus Expenditures - resource centers and libraries; curriculum and instructional staff development
Support Services - guidance and counseling; social work; health services; food services; co-curricular/extracurricular activities; plant maintenance and operations; security and monitoring; data processing services
Problem - not focusing on where money is spent on students
Number of Students -

LEP - limited English proficient; fraction of total number of students in school designated by Language Proficiency Assessment Committee (LPAC) as LEP

Disadvantaged Students - sum of students eligible for free or reduced-price lunch or eligible for other public assistance, divided by total number of students
Problem - average 61.9% of students!
Gifted/Talented - as percent of total students

Neighborhood Characteristics
Race -

Median Family Income (I_{jk}) -

% Population with College Degree -

% of Family Households -

District Characteristics (school k) - constant across schools in a district

Instruments for "Difficulty-to-Educate" -
Special Education - as percent of total students

Average Years Teacher Experience - weighted average of full time equivalent count and years of experience

Teacher Tenure - years in same district

Student-Teacher Ratio - total number of students divided by total teacher FTE

Attendance Rate - fraction of school days attended by students

School Drop Rate - fraction of all students enrolled who quit

4. Sample:
   Source:
   Socioeconomic information from 1990 Census of Population and Housing
       Assumed that census tract is the attendance zone for the school in that tract
       Problem 4046 census tracts, but only 1960 schools?
       Linked schools to tracts based on lat-long from address
   Public school district data form 1992 census of governments
   Performance data from Academic Excellence Indicator System (AEIS) on Texas
       Assessment of Academic Skills (TAAS)... includes student characteristics, staff
       characteristics, school finance and academic performance indicators from 1996-1997
       academy year
       Problem - census info changed over 6 years?

   # data points:
   3664 schools... drop those without mailing addresses (or with PO boxes) and end up with
       1960; those with less than 120 students (18 schools), and top and bottom 1% based on
       expenditure per student... results in 1901 elementary schools (309 districts serving 1.1
       million students)
       "There is no a priori reason to believe that there is a selection of bias associated with the
           sample selection method adopted" (7)... self approval?

   Is sample appropriate or optimal for study?
   Demographics - some summary stats are questionable... average 18% college? does this
       come from adding straight percentages or is it weighted based on population?
   Elementary - only looking at elementary schools for demographic data, but using TAAS
       scores from 7th, 8th and 10th grade (in addition to 3rd and 4th)
   "The most important pupil characteristic that determines educational outcomes is the
       unobserved innate ability of the pupil. Effective techniques for quantifying the innate
       ability of pupils for empirical analyses are scarce" (9)
   "Governments skew funds toward schools with high proportion of hard-to-educate pupils"
       (11)... need something to measure relative difficulty-to-educate
   Disparity - "disparities in the outcome variables are not as stark as the input disparities"
       (13)

5. Analysis
   Statistical Technique

   $Pass_{jk} = ... \alpha I_{jk} + \beta E_{jk} + \rho I_{jk} \cdot E_{jk}... \quad \dfrac{\partial Pass_{jk}}{\partial E_{jk}} = \beta + \rho I_{jk} \quad \therefore \rho > 0 \Rightarrow$ effect of expenditure increase

       on pass rate is larger in high-income neighborhoods
   E_{jk} correlated with error term... school spending determined endogenously as function of
       neighborhood characteristics (e.g., spending high in neighborhoods with certain
       characteristics)
   2SLS -

Instruments - % student body in special education program
Variables in Expenditure & not in %Pass:
- #Students^2 - significant
- % Free lunch - not significant
- % Special ed - significant
- % Same dwelling in 1985 - not significant
- % 5-17 - not significant
- % 30+ minute commute - not significant
- % Homes owner occupied - not significant
- **Problem** - % special ed increases spending, but the special ed kids don't take the test; ** should've netted expenditures for special ed

Results

Rich - "pupils form rich families perform better than pupils from poor families" (13)... goes back to endogeneity problem

Expenditures $\uparrow \Rightarrow$ Pass rates $\uparrow$

Income $\uparrow \Rightarrow$ Pass rates $\uparrow$

Expenditure·Income $\uparrow \Rightarrow$ Pass rates $\downarrow$... i.e., "marginal effect of spending on achievement is decreasing in income" (16) "leading to the conclusion that the marginal productivity of education dollars is stronger for students from low-income families" (17)

Expenditure -
- # students - significant and -
- # students^2 - significant and +; scale economies
- % LEP - not significant
- % economically disadvantaged - not significant
- % special ed - significant and +
- % gifted/talented - significant and +
- % living in same swelling as 1985 - not significant
- % black - significant and positive
- % Hispanic - not significant
- % other - not significant
- Median family income - significant and negative
- %5-17 - not significant
- % college degree - significant and +
- % families - not significant
- % >30 min commute - not significant
- % owner occupied - not significant
- **Problem** - could have multicollinearity problem (too many variables)

Pass Rate -
- % LEP - significant and -
- % gifted/talented - significant and +
- % black - significant and -
- % Hispanic - significant and +
- % other - significant and -
- % parent with college degree - significant and +
- % families to households - significant and -
- spending per student - significant and +

6. Does paper do a good job of testing theory?
    Are there serious flaws?
    "Hispanic residents in the neighborhood are associated with high pass rates... a 10
        percentage point increase in the proportion of Hispanic residents is associated with a 0.9
        percentage point increase in pass rates" (15)... that's high pass rate?!... confusing
        statistical significance for economic significance?

    How can the empirical work be improved?

    Looking for favorites among schools within a district - look at within district spending and
        look at standard deviation; if stdev is sizeable within a district, there could be evidence
        that some schools are getting much more money than others
        Dependent variable - school income / district income

    ** Didn't carefully consider why variables were included

    "Good example of what not to do" -Kenny